

SCAMP, the little loco with a big heart.

Assembly instructions for the mechanical and electrical parts of the Mk4 version.



This follows on from the frame and bodywork instructions.
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General notes

The Scamp is a collaboration between it's designer Colin Edmondson and Chris Dixon of CMD Engineering, who sells both the kits and ready to run Scamps. Prototypes of all the Mk4 variations have been built and tested, design changes since the initial prototype build may result in your parts not looking exactly like the illustrations.

As we have no input once the kit has been delivered to you you build it and use it at your own risk. If you have any doubts please ask, my email address is at the top, or make use of the 'Scamp Owners Club' facebook group.

Part of the design ethos of the loco is to use easily available commercial parts for all the items which may wear out, so that spares can be easily and cheaply obtained.

Some of the laser cut mild steel parts are supplied pickled and oiled, you will find it easier to clean and degrease them before bolting up the assemblies. The steel is then unprotected and needs to be kept dry or surface rust will form.

The laser cutting sometimes leaves a small amount of oxide on the edge of the cut, particularly on thicker steel. I use the back of a hacksaw blade and a wire brush to scrape it off. You only need to remove anything that is loose to give the paint a good key.

Lightly sanding or scouring the surfaces before bolting together is a lot easier than doing it afterwards. If you are going to use acid etch paint as a primer the scouring or sanding is not really required. Remove the nibs left by the laser cutting process, particularly from the inside of any holes where bearings will be pressed in.

Tools required

I am assuming that you already have the basics, electric drill with clutch settings, spanners, hacksaw, screwdrivers etc

Twist drill set up to 6mm.

Allen keys.

Use of a lathe for an hour to turn the taper on the pulley parts, or these can be supplied ready machined on request when you order your kit.

Angle grinder with a fine grit flap disc and 1mm cutting disc.

If you intend fitting your own layshaft sprockets and wheels then you will need an arc or MIG welder or the help of a mate who can do a few welding jobs for you. These jobs can also be done by CMD on request when you order your kit.

Pop-rivet gun.

Wire strippers and decent quality crimping tool.

Staple gun for seat covering.

A battery drill with adapters for allen keys, 10mm and 13mm sockets will speed things up a lot, the average 1/4" drive socket set contains all that you need.

Painting

Thinking ahead, I suggest painting once the axlebox assemblies have been put together and before all the mechanical and electrical parts are fitted.

Axle sprockets.

Axles are supplied by CMD with the wheels already welded in place.



When designing the Scamp I choose to use taperlock sprockets on the axles and mount them outboard of the wheels so that they could be quickly removed and replaced with different sizes depending on the speed limits of the track where the loco is going to be used. If you want to use the Scamp as a slow speed hauler with a sensible top speed of around 5-6 mph choose 27 tooth sprockets, or 24 tooth for a compromise between pulling power and not being a rolling road block!

Axles and taperlock bushes need to be cleaned and grease and paint free, note that the bushes are sometimes supplied oiled for rust resistance and the bore may need to be degreased. Put a spot of oil on the thread of the screws as you put them in. The sprocket is set with a 10mm gap between sprocket and wheel face, using the head of an M6 bolt as a guide. The socket screws are tightened up a bit at a time, first one side, then the other, then the first side again, until they are as tight as you can get them. Then tap the centre boss inward with a copper hammer and tighten them again, and again.

If you need to reposition or change the sprocket undo the set screws and fit one of them in the central hole instead, tighten it fully then tap the sprocket inwards with the hammer on the opposite side to the screw and it should release immediately.



Axleboxes and springs



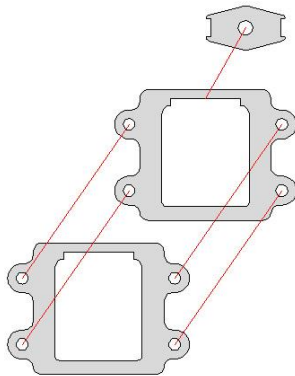
First clean the nibs left by the laser cutting process from the insides of all the axlebox and layshaft bearing mounts. Take two 6mm thick axlebox pieces. Sometimes the bearings will go in with finger pressure only, if so breathe a sigh of relief! If not continue as follows. Gently press a bearing into one piece using the vice as seen in the first photo above, doing your best to keep it square, turning it frequently and doing it a bit at a time. You should find it suddenly enters the hole and presses in smoothly. Then press a second piece on to the bearing, closing up the gap and finally setting them on top of the vice jaw and tapping them with a hammer to get them perfectly aligned. If they seem very reluctant to go in then use a half round file to ease the hole, if they are too tight it can compress the bearing leading to failure in service.



< The thread on the rubber mount needs to be cut down to less than 4mm long before assembly, cut them with a hacksaw or a cutting disc in the angle grinder.

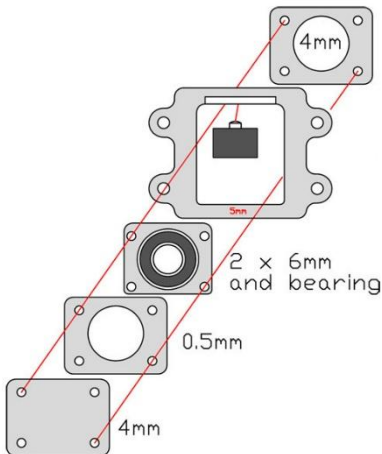
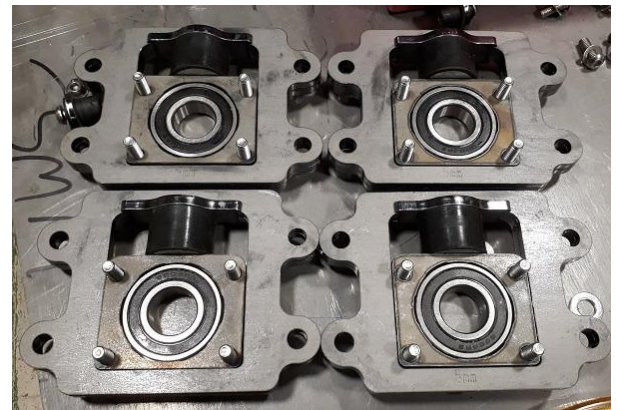
> Push four M6 x 35 screws fitted with washers through the

axlebox outer covers, the thin spacers and the bearing housing. Make sure that you align the parts so that the tops of all four pieces are level, as this is the surface that the rubber spring sits on.

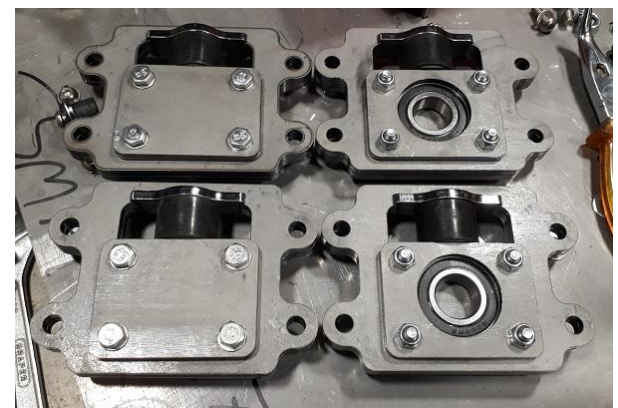


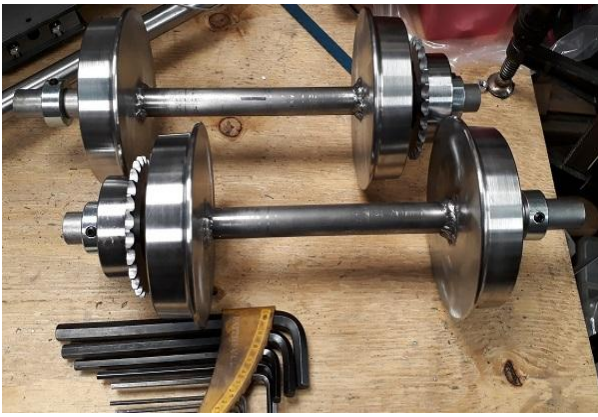
< Assemble the horn guides, using one 5mm thick and one 6mm thick horn guide for each guide, the order doesn't matter. Now try the axleboxes for size in the slots in the horns. Clean up the sides with a file or angle grinder if required.

> Add the spring top mount and the rubber spring and place them over the axleboxes.



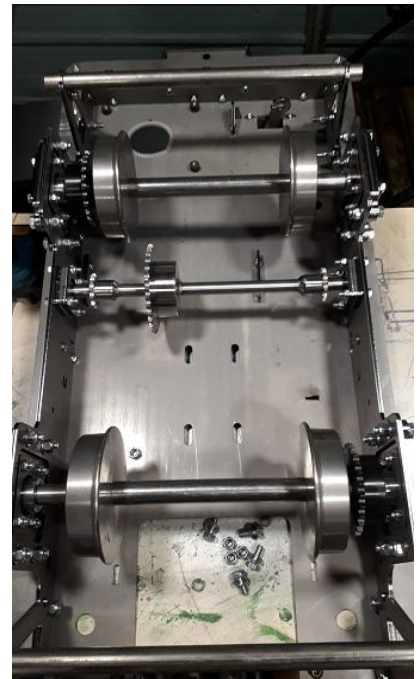
> Finally add the inner covers and tighten the nuts.





< Shaft collars are slid onto each end of the axle after fitting the sprockets and before adding the axleboxes.

> Fit two of the axlebox assemblies in place on the frame and bolt them up with the axleboxes in the middle of the holes in the frame. A good dollop of grease is put on each axle end and into the bearing, then the axles are slotted into the frame as shown, with the sprockets at diagonally opposite corners. The opposite axlebox assembly is pushed onto the other end of each axle and bolted to the frame with M8 x 35 screws and nyloc nuts. (You will need to loosen them again later to adjust the chains).

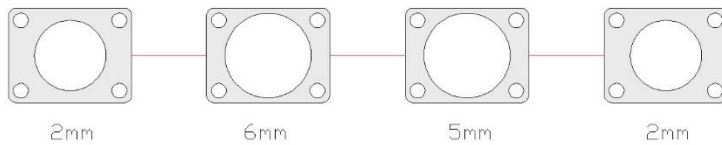


With the axlebox screws tightened up the shaft collars are set as follows. Push the axle fully to one side, push the collar on that side against the bearing and gently nip it up. Then slide the axle fully to the other side, there will now be a gap between the shaft collar and the bearing. Release the screw and slide the collar across until the gap is about half what it was and tighten the grub screw.

Now push the axle across to close that gap and fit the collar on the other side with a 0.5mm to 1mm gap between bearing and collar, shove the collar hard home then move it back by eye and nip it up gently. The collars ensure that the axle ends are kept clear of the outer axlebox covers and the clearance ensures that the axleboxes aren't pressed hard against the frames and can still slide freely up and down. Now check the alignment of your sprockets with the layshaft sprockets, and if necessary adjust the collar positions slightly until the chain lines up and the collars without giving the axle more than 1mm side to side movement. Once you are happy fully tighten the grub screws to lock the collars to the axle and repeat at the other end.

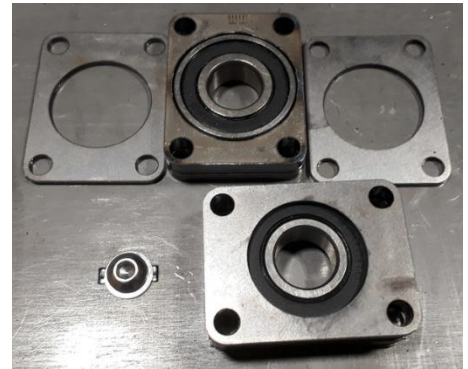
Layshaft

The layshaft itself is supplied as a welded assembly with the sprockets fitted by CMD.



The 15mm bearings are pressed into the layshaft bearing housings just as you did for the axleboxes earlier, using one 6mm thick and one 5mm thick piece each side to suit the 11mm thick bearing, with a 2mm thick piece on the inside for clearance and one on the outside to keep the bearing locked in place.

If you are unlucky you may have to use emery cloth to slightly reduce the size of the ends of the shaft to get it to fit easily into the bearings. The fit needs to be such that it is easy to slide the bearings on and off the ends.



> The laser cut sprockets need to be chamfered as shown, using a fine flap wheel in the angle grinder. This can be done in the vice or after fitting the layshaft in the frame using a gloved hand as a brake to the shaft. Chamfer the edges of the teeth for about half their depth, just enough to give a gentle lead in as the teeth enter the holes in the chain. Chains are capable of accommodating quite a bit of misalignment before they start to catch on the sprocket teeth. The CMD layshaft just fits straight into the frame.



Check that the layshaft fits easily between the frames, it should have a tiny amount of end to end clearance to allow it to spin freely. If it doesn't clear then either bend the frames outwards slightly or file or grind a little off the ends of the layshaft. Spread grease round each end of the shaft to aid assembly and future dismantling and push the bearing assemblies on to each end.



< Lower the assembly into the frame with the large sprocket on the opposite side of the frame to the seat box bracket and fix the bearings to the frame with M6 x 30 hex screws and nyloc nuts. If you are fitting the Lister style side weights they should be attached at the same time.

Motor and chains



Note that the motor sprocket nut is a left hand thread, turn it clockwise to undo it. The motor sprocket supplied has to be replaced with a 9 tooth 06B (9.5mm pitch) one to suit British chain standards, a replacement is supplied with the kit. You may need to ease the hole in the sprocket slightly with a small file before you tap it on, place a suitable socket over the end of the shaft to avoid accidentally damaging the ends of the threads. You should only tap it gently to preserve the motor bearings, safer to file it a bit than to hammer it on. Nut lock adhesive on the thread is a good idea, use the lock washer that came off it and don't over tighten it as the metal is not of the best quality.

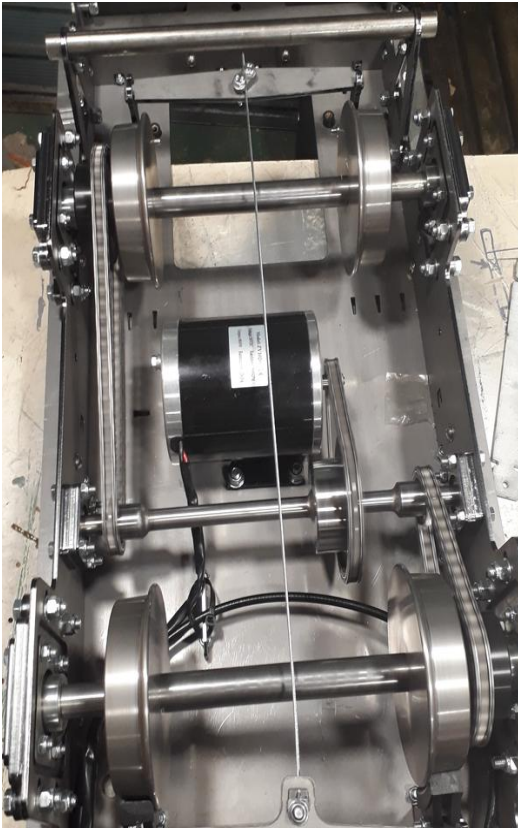
> The edges of the sprocket need to be chamfered as shown to give a gentle lead in to the chain, just using a file is sufficient or stick it over a bolt in the vice and use a flap disc in the angle grinder, the sprocket will spin fast so don't let it escape. Alternatively fit the sprocket to the motor and spin it on a battery while you use a file or grinder to chamfer the sprocket and smooth the edges. You can push the motor connections into the slots on a drill battery.



< I find that this is the easiest way to cut chain to length if you don't have a link extractor. Cut through the outer links with a cutting disc in the angle grinder, taking it a touch at a time so that you only cut through the outer link. Cut both sides and the chain will part leaving the pin free to be pushed out. Alternatively grind the protruding face of the pin flush with the link and drive it out with a pin punch.

> When fitting a connecting link position the two ends of the chain on the sprocket and push the link into place, then move it to one side to fit the loose link, a lot less fiddly than trying to assemble it in the middle of a run. It is good practice to fit the link with the closed end of the spring link pointing in the usual direction of travel, so that if anything catches it then it won't spring off. The motor slides to adjust the primary chain tension, the axles slide to adjust the tension in the secondary chains.





< The photo on the left shows the layout of the motor, chains and sprockets, here seen under test. Take care to keep the axles square, you can check that the position of the axleboxes is the same on both sides by measuring the position of the horn guides in the holes in the frame as shown below, thus keeping the axles parallel and square to the frame. Don't over tighten the chains, as it robs power and leads to accelerated wear in the chain and the motor bearings. The chains should be fitted with a tiny bit of slack, rotate the axles to make sure they don't tighten at any point.



Brakes

> The PNP glass filled nylon brake blocks need to be drilled 6mm in the centre of the radius. PNP have produced a YouTube video showing you how to do this, search for '*Video showing how to drill brake blocks for model and miniature railway locomotives and rolling stock*'. The brake blocks are fitted using M6 x 30 screws and nyloc nuts, note that the brake blocks need to be mounted so that their taper matches the taper of the wheel, so you are making two pairs. The hangers just slot into the footplate and are prevented from dropping out with an M6 x 16 screw, nut and washer. Make sure that the brake hangers can move freely.



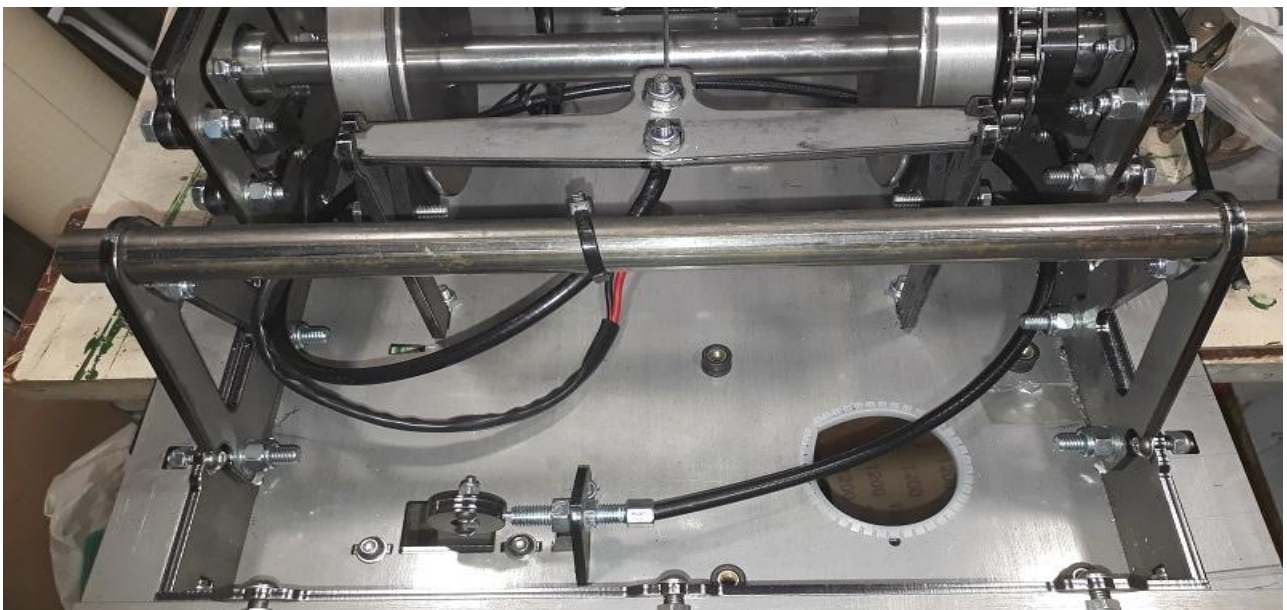
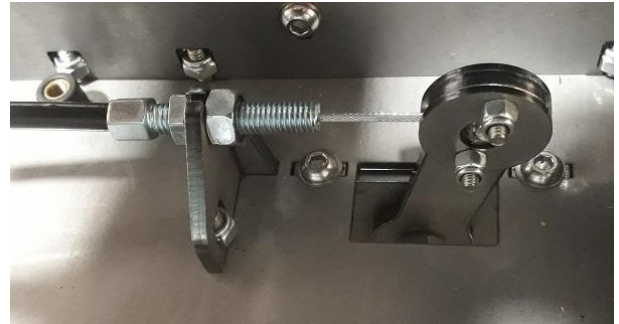
< > The brake equalising beams need the brackets which take the cables breaking off, cleaning up and popping into the slots in the beam, M6 x 16 button screws with washers underneath keep them in place.



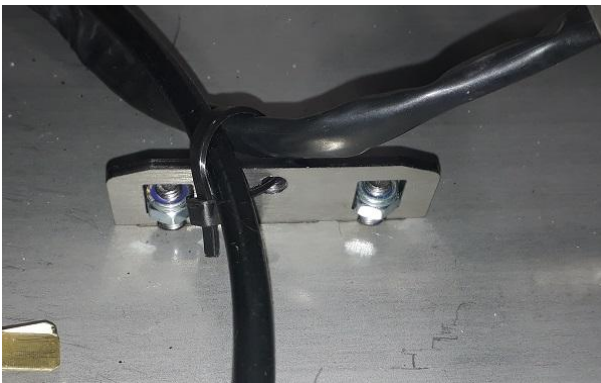
> The free end of the brake cable is clamped in place by the tab, fitted with M6 x 20 hex head screws which are sufficiently long for the nylon insert in the nyloc nuts to get a decent grip.



> Fitting the brake cable to the brake lever has been mentioned in part 1, the cast end lug is trapped between the two discs which are clamped up with two M4 screws. The adjuster is part of the cable kit, and should be fitted so that it just clears the brake lever when the brake is fully off. The second nut is an M8 nyloc nut with the domed end including the plastic insert cut off and filed smooth. The two nuts lock the adjuster in place so it gives a smooth lead to the cable.

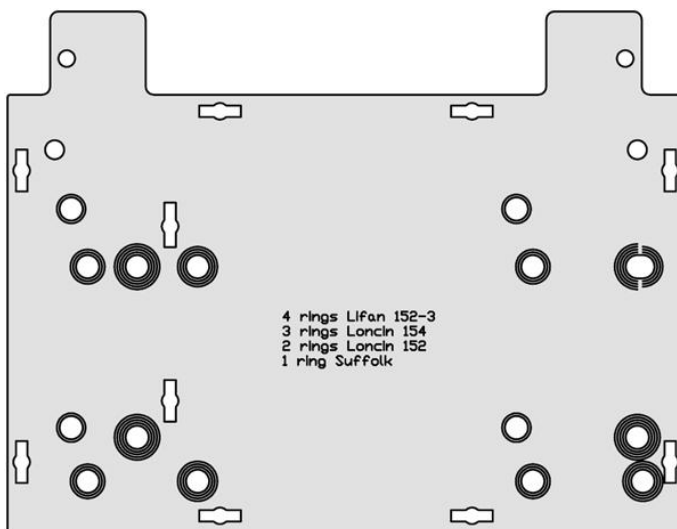


The brake cable is routed as shown. Mirror image for left hand drive. The brake cable outer is cut to length with either an angle grinder or a pair of sharp side cutters. (Don't forget to take the inner out first!). Clean up the end with the grinder so that the inner passes through smoothly. The equalising beams drop into the slots in the hangers and rotate to lock them in place, the photos give you the correct orientation. On the right hand side the brake cable is cable tied to the slot in the frame, it then turns a half circle and is cable tied to the underside of the seat bracket, then tied at the opposite frame slot and then LOOSELY tied to the derailing bar. A ferrule from the kit supplied with the brake cable is fitted to the cut end of the outer and it is slotted into the rear equalising beam as shown. The inner is taken to the front equalising beam and lightly trapped between the beam and the clamping plate. Once the driving chains have been fitted and the correct axle positions have been set the brake lever is put on the first notch, the two beams pulled together with the brake shoes snugly against the wheel treads, and the inner cable pulled through and the clamp tightened. It helps to have a friend to help you at this point, but it can be done alone as long as you have three hands.



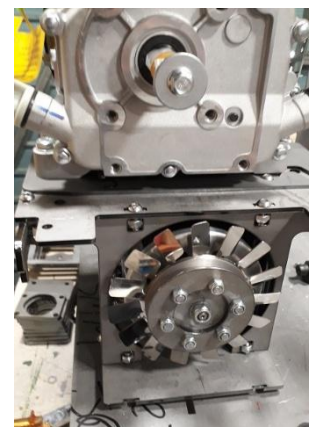
< The brake cable is also cable tied to the underside of the seat bracket, along with the motor wiring.

Fitting the engine



The cradle top plate has holes to accept four different engines, the Suffolk that the loco was originally designed for, the Loncin 152 F which was standard until it fell foul of the emissions regulations, the replacement Loncin 154, and the preferred replacement, the Lifan 152-3. The top plate is marked to show you which holes to use.

The engine spacer plate has to be placed on top of the cradle, then the engine bolted in place. Use M8 screws of the appropriate length for the thickness of the engine base, make sure that the thread fully enters the plastic locking ring on the nyloc nut. Fitting the dynamo comes next.



Dynamo pulley and fan

There isn't a commercially available pulley to fit properly on the very short 'dynamo' shaft, so one has been designed to suit, made from three laser cut discs which are supplied in the kit. Lathe work is required, so the pulley is also offered ready to fit by CMD Engineering as an optional extra.

The two larger discs need to be mounted in a lathe and lightly machined to get the correct angle for the 'vee' belt, use the engine pulley to estimate the correct angle to set the slide for the cut.



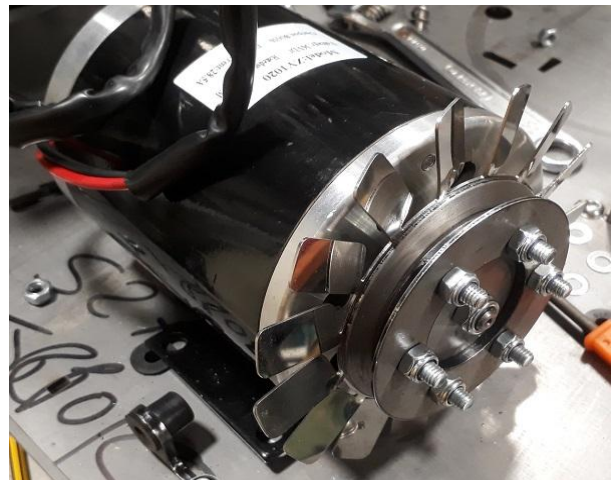
> I couldn't set my lathe top slide to the correct angle, so I had to bodge it a bit as shown in the photo. There is a ring etched on the disc to show you where to stop the cut.



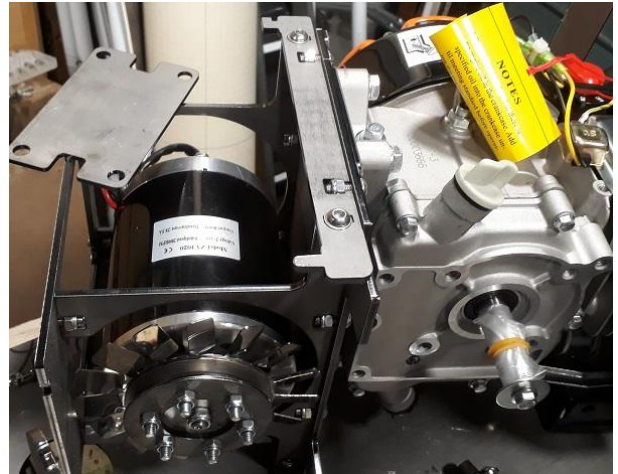
< Peel the plastic backing off the fan blades and use white spirit to remove any sticky residue. Place the fan on top of one of the outer pulley discs and using a pair of small pliers gently twist all the blades on the fan until they just touch the bench as shown on the left, then turn it over and check that all the blades lie flat.

> You can now bolt the fan and discs together with M6 x 20 screws with nyloc nuts and cut off the threads flush with the nuts (not done when this photo was taken). Clean up the 'pip' left in the hole by the laser cutter and try to work the pulley assembly bit by bit onto the motor shaft, if necessary gently tapping it into place with a socket placed over the shaft to avoid damaging the threads. If it really doesn't want to go gently ease the hole with a small file until it starts to go on. Continue tapping until it is seated hard home and then tighten the centre nut (**REMEMBER it is a left hand thread**).

A spanner placed between the nuts will stop the pulley spinning as you tighten it. A touch of nut lock will help to keep the nut in place.

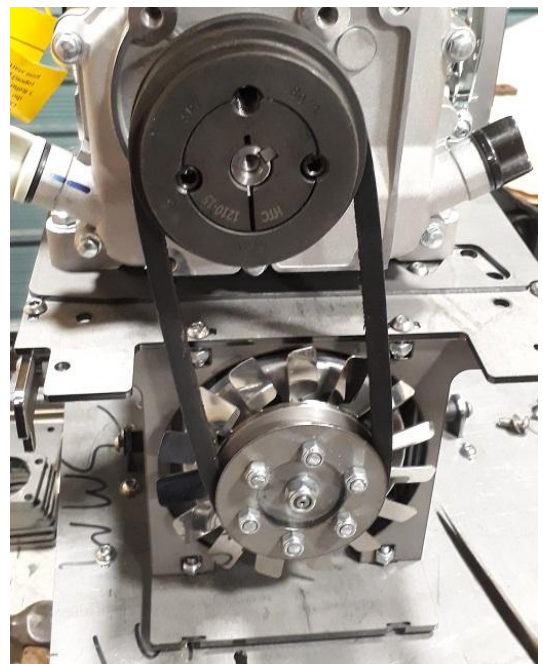


> The dynamo assembly enters the cradle through the hole on the right side, it is easiest to do this with the cradle lying on its left side. Once you have wiggled and wangled it into place slide the spacer plate (here seen sitting on top) between the dynamo foot and the cradle side and bolt the dynamo in place in the cradle with four M8 x 25 screws, washers and nyloc nuts, one of which is a pain to get in, sorry! (Hint, a lump of blu-tac on the end of your finger sometimes helps when getting nuts into awkward places).



The engine pulley

> Fit the engine pulley, wiggle it onto the shaft before tapping the key supplied with the engine into the slot. (Follow the instructions given in 'axle sprockets' above to fit the taperlock bush). The position of the pulley on the shaft is set to line up with the position of the pulley on the 'dynamo', the centres of the two pulleys should line up so that the belt runs true. The dynamo screws are loosened while the belt is slipped on, then the dynamo is gently pushed down to tension the belt and the screws tightened. The belt doesn't need to be too tight, perhaps 6mm play either side of the middle of a straight run when gentle finger pressure is applied.





Throttle lever and cable

< Drill the knob out with an 8mm drill and push it on. Place the outer of the bicycle brake cable in the throttle lever back as shown and feed the inner cable through the hole in the moving lever and through the outer. The outer is cut to a length which allows a tidy routing to the side of the engine. It is easiest to pull out the inner cable, cut the outer with an angle grinder cutting disc, then replace the inner, cut it to length in turn and twist any loose wires back into place.



On both the Loncin and Lifan engines the throttle cable runs above the footplate towards the front of the bonnet, then doubles backwards and upwards to enter the linkage on the engine. Release the tension on the centre M6 nut on the engine lever so that the lever moves very freely, you may have to remove the wavy washer as well.



Fit a bicycle brake cable adjuster into the hole on the engine bracket with a nut on either side, pass the cable through, add the return spring as shown and finally pass the inner cable through the bracket on the right and fit a screwed nipple on the free end. The important thing is that the throttle on the engine must return to idle when the throttle lever on the loco is pulled back.

If your cable set came with an end ferrule you may wish to slip it over the end of the inner cable and crimp it on for tidiness and to protect your fingers from the sharp strands of the cable.

If you are using the Suffolk engine it is a simple matter of replacing the cable as it was fitted to the carburetor on the mower, shortening it to suit.

Electrickery.

Generally speaking the convention is that **red is positive, symbol +ve**, and black is negative, symbol -ve.

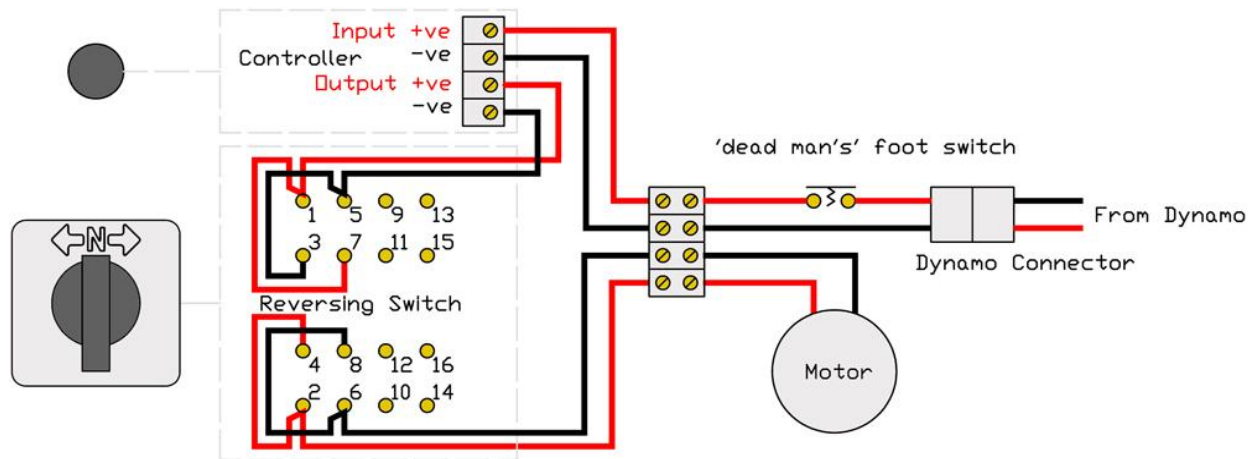
Because of the rotation direction of the motor used as a dynamo the red wire from the dynamo is probably going to be negative and the black wire the positive. As the motors can vary you need to spin the dynamo in the direction that the engine will turn it and check the polarity of the output with a meter. You will probably have to connect the red wire from the dynamo to the controller input negative terminal and the black to the positive, ie. the polarity is reversed. It is important to have the polarity of the feed to the controller correct, if you get it wrong the controller puts a dead short across the dynamo which then acts as a brake and the engine usually cannot be started, if you do manage to start the engine then the controller will melt.

The changeover between colours is best done at the connector between the dynamo and the wiring loom on the loco as shown in the diagram on the next page, as this makes things simpler if you decide to fit a battery box in the future.

I have deliberately not fitted a fuse to the petrol-electric Scamp, as unlike a battery powered loco the current available is limited by the output of the dynamo, and being a matched pair anything the dynamo can produce can be safely absorbed by the motor. A breaker is fitted on the battery box to give protection when operating in battery mode.

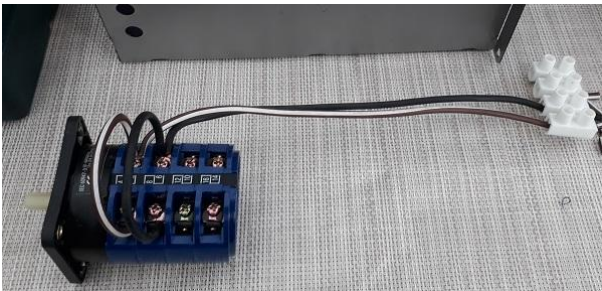
I make up the complete wiring loom for the control box first, and fit all the components in the control box with a connector block hanging out below, this is simply to aid assembly and future dismantling. The output from the dynamo goes first to the controller, as this has to have the correct positive and negative connections. It then goes to the reversing switch, which basically swaps the connections over depending on which way it is set. When the switch is turned one way the input positive connects to the output positive and negative to negative, the centre position is off and the other way positive connects positive to negative and negative to positive to give reverse.

Never operate the reversing switch unless the loco is at rest with the control knob switched off, the stop will be so sudden it may throw you off and things may go bang.



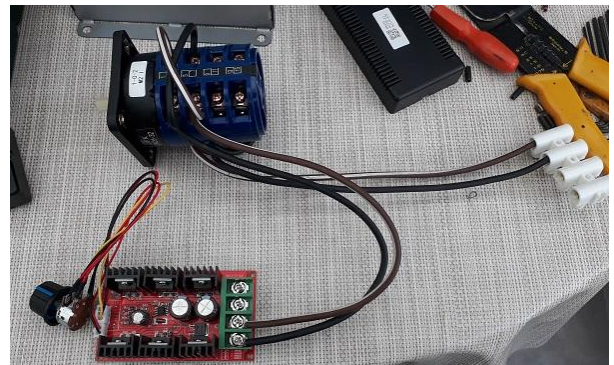
NB. Follow the markings on the controller terminals rather than slavishly following the terminal positions shown in the diagram, they do vary in position, and sometimes it will say 'motor' instead of 'output'. Note that the change in colour of the wiring from the dynamo occurs at the dynamo connector, this makes things a lot easier if you decide to add a battery box in the future.

Control box



< I first connect the reversing switch output wires to the connector block, the positive to terminal 2 looping to terminal 4 and the negative to 6 looping to 8. (I had plenty of brown wire but no red, hence the colour choice). Leave the wires a little bit longer than shown here.

> Open the black plastic case of the control box by inserting a small screwdriver in the slot and twisting it. Discard the plastic packaging and remove the board. The positive wire from the controller output block goes to terminal 1, then loops to 7. The negative goes to 5 and loops to 3.



< Finally the reversing switch output wires are connected to the connector block. This is what you are aiming to fit into the control box. The supply from the dynamo comes through the hole in the footplate, which is suitably protected with a length of grommet strip to prevent the wires from chafing. The connector block normally sits above the footplate level but the wires should be left long enough to let it be pulled down through the hole for easy connecting and testing.

The new control handle provides enough leverage to break the plastic stop inside the potentiometer, thus allowing you to go past 'stop' to 'full speed', with potentially interesting results. To prevent this from happening the new handle incorporates two lugs which at full travel engage with the top of a screw projecting from the top of the control box to protect the delicate potentiometer.

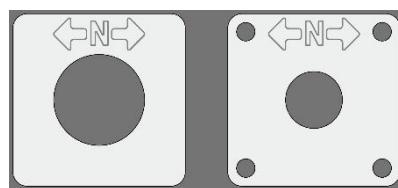


It is rather fiddly fitting this M4 x 10 screw into the small hole in the box top from below, then holding it in place with an allen key while you screw a nut onto it, but ignore it at your peril. The screw needs to be trimmed to leave about 2mm of thread exposed beyond the nut and the end cleaned of sharp edges.

You need to enlarge the hole in the end of the plastic control box to make room for the large wires, I make two cuts with a fine hacksaw and score between them with a Stanley knife, then snap off the waste. Once connected up fit the control board into the box, lead the fine wires outside and snap it shut.

> Undo the locking nut and pop the potentiometer into place in the hole on the top of the switch box and gently tighten the nut, it is easy to strip the threads if you tighten it too much. Make sure it is not fouling the head of the M4 screw. Fix the control box in place inside the control box with either double sided tape or preferably self adhesive magnetic tape as shown.

Undo the screw in the top of the knob on the reversing switch and pull the knob off. There are two different models of reversing switch, I have called them Type A, with a plastic centre spindle and fixing nuts trapped in the body, seen in the photos above, and type B with a square steel spindle and the nuts supplied loose. Two trims are provided to suit either type.

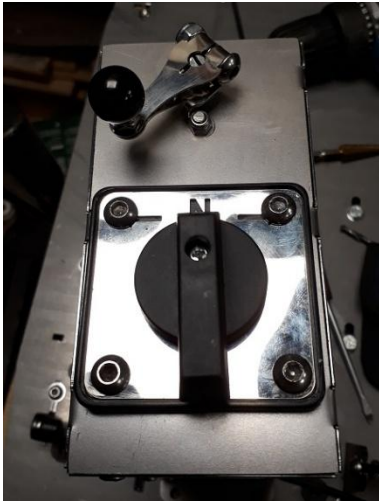


Type A Type B

Type A. Spring out the black ring in the middle and release the silver plastic insert. You can now fit the switch into the control box with the screws included in the box, briefly pop the knob back on to check that you have got it the right way round (pointing to the speed control) as it only fits on the spindle one way. The body of the switch has trapped nuts, don't press too hard on the screws as you drive them in or the nut may fall out and it is a very fiddly job trying to get them back in.



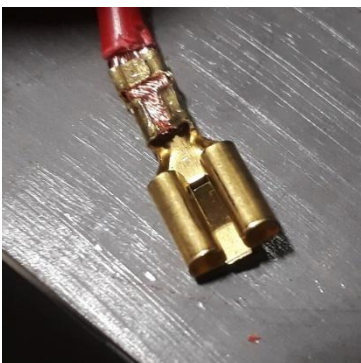
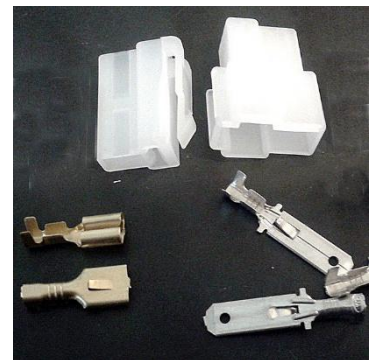
Once the black plastic cover is screwed up fit the new stainless insert, pop the black ring back in to hold it in place and refit the knob.



Type B. This type has a square steel shaft and the knob will fit on any of four ways, so the alignment of the switch doesn't matter. Prise out the silver plastic top and replace it with the stainless top with the four holes in it. The separate nuts are almost impossible to fit in the confined space, so fit it with four M6 x 16 button screws, driving them into the holes in the plastic body. Refit the knob.

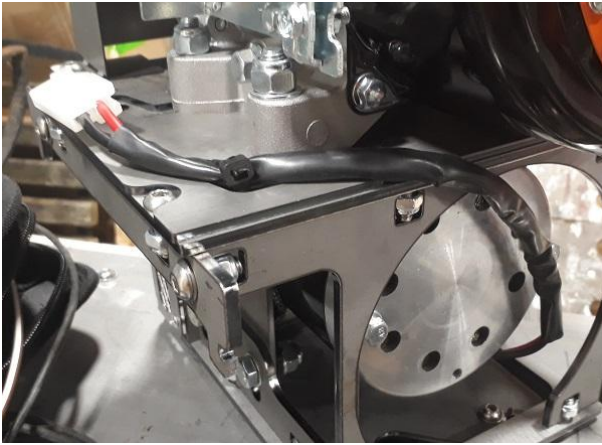
Cable and wiring routing

> The wires from the dynamo are cut back to about 200mm long and one half of the plug and socket fitted, ideally the socket as shown below as the potentially live ends are better protected when the unit is being tested on the bench, and definitely safer when the unit is replaced by an optional battery box, nothing like thinking ahead! I fit the positive as the 'upright' of the 'Tee', and the negative as the crossbar, not forgetting that the polarities and therefore the wire colours are probably reversed.



< The wire has to be firmly crimped into the connector, if you are using one of the cheaper crimping tools you may want to think about soldering it in place as well. I used one of the heavier duty crimping tools with interchangeable heads.

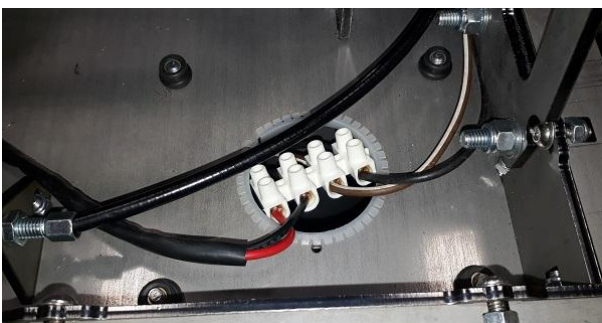
I suggest cutting off the clip that normally holds the two parts of the plug and socket firmly together, sooner or later you will lift out the engine and generator unit without disconnecting it first and it is far better if the two halves can part company easily rather than the wires pulling out of the connectors. Failure to achieve forward motion is most commonly caused by dropping in the power unit and forgetting to connect the plug and socket up!



> The wires passing back to the control box are fed through the hole in the footplate, which should be protected with some grommet strip. The spare cable sleeve that you cut off the motor wires is slid over the wires right up to the connector.



> The wire to the motor is clipped to the underneath of the seat bracket.



< The wires are brought up the back of the cradle in the centre and cable tied through any available left over engine mounting holes.



< The wiring from the other half of the plug and socket runs back to the controller and reversing switch along the inside of the frame to the connector block under the switch box. On both sides of the frame are 'C' shaped slots to take cable ties.



< It is then tied to the inside of the frame and led to the connector block underneath the control box.

< If required the foot operated 'dead man's' switch seen in the photo is pushed up through the hole in the footplate from underneath and it's rubber cap screwed on. It is connected into the wires from the dynamo or battery box to the controller, not the wires to the motor. It is operated by the driver's right heel.



There is a knack to twisting the ends of the wire to make a good connection with the screws on the switch, as shown. Split the wire into two parts and twist the cores together, wrap the two halves round a twist drill of the right diameter to match the screw on the switch and twist the ends, add a drop of solder and cut off neatly. This creates a neat (ish) loop to fit onto the screw terminal on the switch.

Painting

There are two schools of thought here, or perhaps three.

School one, which includes me, finishes the main assemblies, paints them, bolts them together and adds the mechanical and electrical parts.

School two like to keep screw heads shiny so paint every single part separately and then try to assemble them, generally finding that a lot of paint is removed when pushing tabs through slots, so needing a lot of touching up.

School three likes to build up completely, test run, then strip and paint.

It's entirely up to you which avenue you choose, but I do recommend a really thorough degreasing, not just white spirit but something like thinners or panel wipe, followed by a first coat of acid etch primer, which gets a really good hold on the surface. This can be spray or brush painted, but may need thinning. If using conventional metal primer then a good scouring of the surface with a pan scrub and degreaser helps the paint to grip by roughening the surface.

My own choice is to spray outdoors on a warm, calm day with two pack paints, but they are nasty and need to be treated with respect, a full suit and charcoal filter mask are needed. Your local car trade paint supplier can help a lot if you want to go the spray route.

Trimming and finishing



Fit edge protector round the base of the seat box and round the rear cab sheet if fitted. You might want to add some neoprene foam strip under the lid, and some rubber matting to the floor in front of the seat and on the slot in footrest.

I like to add 25mm red heat-shrink tubing to my brake lever, just cut a 100mm length off, slide it over the painted lever and warm it up with a hairdryer or heat gun to shrink it into place.

Add plastic end caps to the ends of the lever and derailing bars.

Cut some squares of clear sticky back plastic film about 40mm long on each side and fit them over the holes in the footplate where the bonnet legs and slatted seat legs engage, they will help to protect your paintwork.

Suffolk fuel tank

If you are using the Suffolk engine and your engine came with the fuel tank mounted on it all well and good. If it came with a handlebar mounted tank modify it as shown by flattening the lugs and bending them to a fairly snug fit around the engine housing. Drill and add short M5 screws and nyloc nuts to hold it in place as shown. This small capacity tank will not last a full days running.



Preparation and maintenance.

Lubrication

I suggest regular chain spraying with a proper spray chain lubricant, this is easily done with the frame turned over on the bench. Put newspaper beneath the chains to catch the worst of the over spray. Keep the chain tension correct, it shouldn't be tight or too loose, just a touch of slackness in them, enough to be visible when you rotate the wheel back and to. Removal of the engine and dynamo cradle and turning the frame over makes this work so easy that you have no excuses for not keeping on top of the job.

The axleboxes need a drop of chain lube or heavy oil now and again, a drop in each side where the surfaces slide.

A drop of oil to throttle and lever moving parts now and again will help keep things moving sweetly, don't overdo it.

Every couple of years, or less if intensively used, remove the chains and try the axle and layshaft bearings for smoothness while rotating them by hand, any noise or roughness means they need to be replaced. This is easily done by putting a socket of a slightly smaller outside diameter on one side of the bearing, and a larger socket or a piece of heavy tube with a bore greater than the outside of the bearing on the other side and pressing the bearing out in the vice.

Keep an eye on the drive belt for cracking, it is easily changed so keep a spare in the seat box.

Keep an eye on the brake cable to see that there are no broken strands, replace it immediately if you do find one, making sure that you use the correct heavy duty cable. If you hear 'ping' sort of a noise when you pull on the lever then check it immediately, it is your only means of stopping!

Brake shoes should last for years, and are easily adjusted by taking up the slack in the cable adjuster beneath the lever or releasing the cable end clamp on the brake beam and taking up the slack in the cable. They should not be allowed to run too slack as they will start to chatter and the linkage may hang down too near the track and get caught up. Always readjust after setting the chains.

If you have chosen to fit a new engine then maintain it as per the manual. On Suffolk engines change the oil once a year.

Ready for use.

The rear of the engine and dynamo unit drops into the tapered slots in the footplate, the pegs at the front drop into slots in the footplate, the fixing down is covered in the frame instructions. The electrical connector to the dynamo can then be connected.

The fitting of the seat box, rear cab sheet and slatted seat are all covered in the frame instructions, these are normally left in place.

Having topped up the fuel tank the rear legs of the bonnet are slipped into the tapered slots in the footplate, the front slot dropped over the screw and the screw tightened. You may prefer to use a Philips head screw for the bonnet fixing, as there is less chance of slipping and damaging the paint than if a spanner has to be used. The throttle lever can now be slipped over the projecting screws on the bonnet rear leg and the wing nuts tightened. Ready to go!

I do hope that you find this loco both easy to build and a pleasure to use. I have enjoyed designing it, building the prototypes and refining the design, and look forwards to seeing photos of your build as it progresses. Take care and have fun, **Colin Edmondson**

colin@colinedmondson.com

I suggest that you join the 'Scamp locomotives' facebook group, we are a helpful lot!

Optional Scamp battery box instructions 24 volt and 36 volt versions

Be very careful when working with batteries, there is a lot of potential energy stored in one and a short circuit can create a great deal of heat in a very short time. Always be aware of this when connecting up and especially when working with a spanner inside the box, make sure that there is no chance of it touching the box or a bare wire of the opposite polarity. The breaker will guard against any short circuits or overloads outside the box, and can be used as an isolation switch when the loco is left unattended.

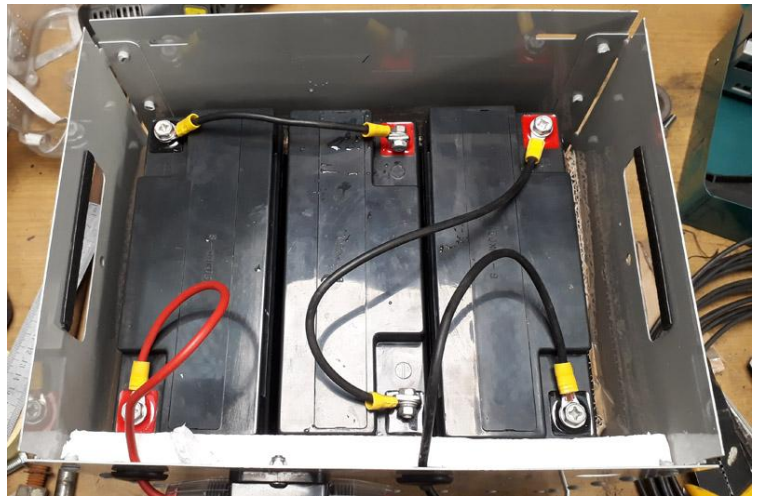


Fit the breaker into place with the M3 screws, cut off any protruding screw on the inside and smooth any sharp edges. Add the grommets and pierce their centres to take the wires.

Cut a piece of thin rubber matting to line the inside of the battery box and try lowering the batteries into place. The pair of larger batteries are a tight fit in the box as the box had to be sized to fit under the existing Scamp bonnets, you might find that you need to use a pair of side-cutters and a rough file to slightly shorten the protruding ends of the rivets inside the box to make sure that they won't rub on and possibly wear their way through the battery sides.



24 volt version



36 volt version

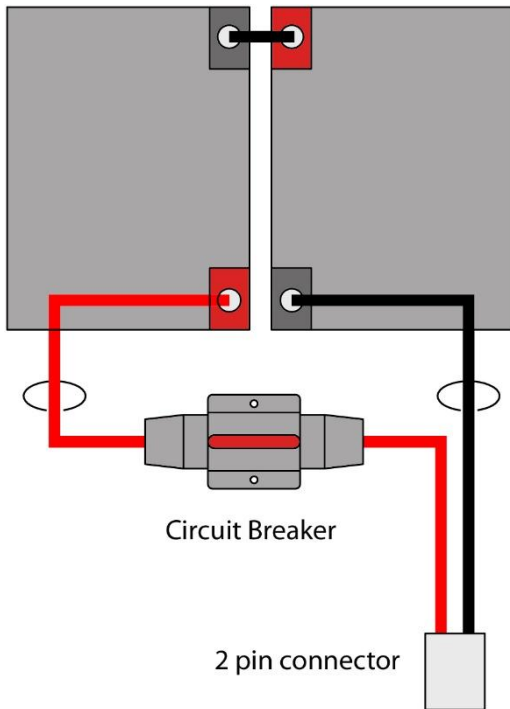
With the batteries in place thread a length of M6 studding through the holes in the ends and add a nyloc nut at each end, this keeps the batteries in place and prevents them jumping up and possibly shorting out on the inside of the lid (think of the loco on a trailer going over speed humps!).



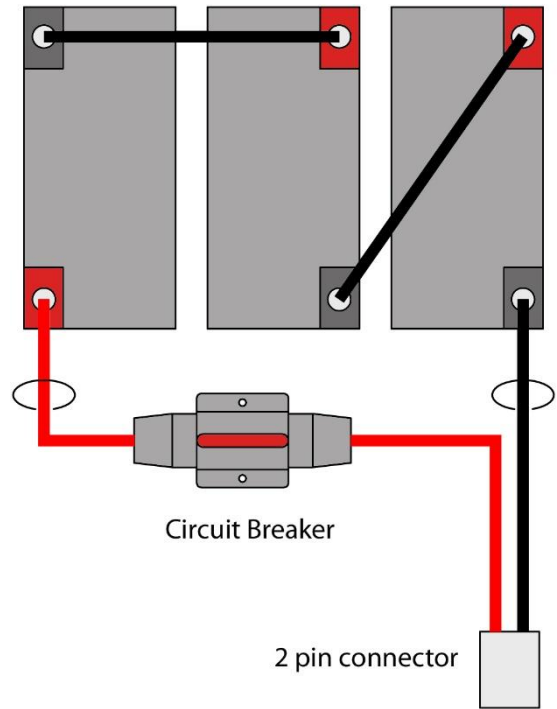
Edge trim is fitted to the upper edge of the lifting slots to protect your fingers when lifting it as the completed battery box is heavy. Because the battery box is held in place on the loco only by its own weight, you need to think about adding an extra securing strap to hold it in place when you move it in the back of a vehicle or on a trailer.

You also need to fit a couple of lengths of edge trim to the bottom edges of the box to prevent it removing paint from the footplate, and if you have any left you can add some round the upper edges for the lid to sit on.

Wiring up



24 volt version



36 volt version

Run a 4mm square red wire from the positive battery terminal through a hole punched through the grommet to one end of the breaker and from the other end of the breaker to the connector, which is the same one used in the petrol-electric Scamp. Run a black cable from the battery negative to the other side of the connector. As well as crimping the wires to the spade terminals in the connector I think it is safer to solder them as well. Make sure that the wires are long enough to reach the connector on the loco. Wrap cable tidy round the wires for protection.

If you are building this as a swap over for your existing Scamp you may need to wire the plug and socket the opposite way round to your existing one. The output from the dynamo generally but not always has it's positive output on the black wire and negative on the red wire, the battery box has positive on the red wire and negative on the black. If you get it wrong the controller will go up in smoke and will have to be replaced. **Check, check and check again.**

Connect the other half of the socket you have bought to the charger lead as shown in the photos, it is a lot safer to use a meter to check the polarity of the charger wires, yours may be different to the photo below. Finally connect the other battery terminals together as shown in the diagrams and photos. As you can see, I use crimped ring connectors to connect to the batteries, I bought the more expensive crimp tool to ensure that I got a well crimped joint that is capable of handling the currents involved. The battery box is now live, so take care.

